

THE CITY OF OREM

TRAFFIC CALMING TOOLBOX



ADOPTED 2015

PREPARED BY

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E N G I N E E R S

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INTRODUCTION

The process of selecting suitable traffic calming measures involves, first, identifying the nature and location of the traffic problem i.e. speeding, congestion, and then selecting the appropriate traffic calming measure capable of solving the identified problems. The traffic calming measures should be selected from a “toolbox” of possible alternatives that describes the possible measures with their application and effectiveness at solving specific traffic problems.

This document, designed as a companion to **THE CITY OF OREM – GUIDELINES FOR TRAFFIC CALMING** describes the traffic calming measures that may be considered by The City of Orem as alternatives to solving traffic problems. In this document the following five groups of traffic calming measures will be described in detail:

- Non-Physical Measures
- Volume Control Measures
- Vertical Speed Control Measures
- Horizontal Speed Control Measures
- Narrowing Measures

Specific measures within each group will be identified and their application, cost and effectiveness described. In addition, a summary of the appropriateness of each type of traffic calming measure in dealing with different traffic problems will be presented. Finally an overview of the design principles that should be applied in designing each type of traffic control measure will be explained. In some cases it may be appropriate to combine two or more specific types of traffic calming method to either enhance the effectiveness of one or the other or to potentially address two separate problems. A scenario such as this one should be identified and analyzed on a case by case basis.

1.0 NON-PHYSICAL MEASURES

Non-Physical Measures are measures such as signage or speed enforcement that do not require any construction or physical modifications to the roadway. These items can be attempted first since they can be economical and easy to remove if they do not solve the problem. Non-physical measures have been shown to have negligible success when used as traffic calming measures.

1.1 SPEED ENFORCEMENT

For areas where speed has been determined as being excessive (generally an 85th percentile speed 7 mph above the posted speed limit), speed enforcement can be a temporary traffic calming measure.

TARGETED SPEED ENFORCEMENT can be attempted on areas where speeding is observed by neighborhood residents and/or agency representatives. Limited personnel can be cost-effectively deployed on major roadways. For low volume streets, periodic daytime speed enforcement is the best option. Because of the expense to maintain increased levels of police enforcement, targeted speed enforcement should only be used temporarily and/or in conjunction with other new traffic calming measures to help drivers become aware of new restrictions.

Another available enforcement option is a **RADAR TRAILER DEVICE**, which measures and displays a vehicle's speed as it approaches. The posted speed limit is shown in clear view next to the digital readout showing the actual speed of the oncoming vehicle. This reminds drivers to slow to the appropriate speed and often it comes as a surprise to the driver to see how fast they are travelling. These devices can be easily transported and deployed at different locations.

Effectiveness: Negligible



Figure 1: Radar Trailer Device

Advantages

- Inexpensive if used temporarily
- Does not require time for design
- Does not slow trucks and emergency vehicles

Disadvantages

- Expensive to maintain for a long period
- Trailer subject to vandalism

1.2 RADAR SPEED SIGN



The **RADAR SPEED SIGN** is very similar in nature to the radar trailer device. The notable difference between this device and the radar speed trailer is that the radar speed sign is not portable. The device can also have the ability to store data over time to provide speed data to the City. This device measures and records a vehicle's speed and displays it next to the posted speed limit sign, reminding vehicles to slow to the appropriate speed.

Effectiveness: Negligible

Figure 2: Radar Speed Sign

Advantages

- Can mount to existing poles
- Does not require much time for design
- Does not slow trucks and emergency vehicles

Disadvantages

- Has not been shown to significantly reduce speeds
- High cost of long-term maintenance

1.3 LANE STRIPING

LANE STRIPING can be used to create formal bicycle lanes, parking lanes and/or edge lines. The striping “narrows” the travel lane for vehicles and may encourage drivers to lower their speeds.

Effectiveness: Negligible



Figure 3: Bike Lane Narrowing

ADVANTAGES	DISADVANTAGES
Inexpensive	Increases regular maintenance
Can be used to create bicycle lanes or delineate on-street parking	Has not been shown to significantly reduce travel speeds
Does not require much time for design	
Does not slow trucks and emergency vehicles	

1.4 SIGNAGE



SIGNAGE such as speed limit and various restriction type signs can be used as a traffic calming measure. Speed limit signs should only be placed after an engineering study is performed. Restriction type signs include: NO TRUCKS, CROSS TRAFFIC DOES NOT STOP, NO RIGHT TURN, NO LEFT TURN, NO THRU TRAFFIC.

Effectiveness: Negligible

Figure 4: Typical Signage

ADVANTAGES

Inexpensive

Turn restrictions can reduce cut-through traffic

Does not slow trucks and emergency vehicles

DISADVANTAGES

Ineffective if not accompanied by enforcement

Speed must be set at a reasonable value for drivers to follow

Has not been shown to significantly reduce travel volume or speeds

1.5 SPEED LEGEND

SPEED LEGENDS are numbers painted on the roadway indicating the current speed limit. These are usually painted near the speed limit signposts. Speed legends may be useful for reinforcing speed reduction between different roadway segments (e.g., from one functional class to another or at major residential entry points).

Effectiveness: Negligible



Figure 5: Speed Legend

ADVANTAGES

- Inexpensive
- May help reinforce a change in speed limit
- Does not require much time for design
- Does not slow trucks and emergency vehicles

DISADVANTAGES

- Has not been shown to significantly reduce travel speeds

1.6 ANGLED PARKING



Figure 6: Angled Parking

ANGLED PARKING can be used to reduce the width of a travel lane, which will likely reduce vehicle speeds. Angled parking may also increase the number of parking spaces available on a roadway. Angled parking changes the parking position from parallel to a 30°-60° angle.

Another option available is called Reverse Angled Parking. Like parallel parking, the driver enters the stall by stopping and backing up. In contrast to standard angled parking, the visibility with exiting reverse angle stalls is much improved. When exiting, the driver does not blindly back the rear half of the vehicle into the travel, rather they are able to pull forwards out of the parking stall.

Effectiveness: Negligible

ADVANTAGES
Reduces speeds by narrowing travel lanes
Increases the number of parking spaces
Makes parking maneuvers easier than parallel parking
Favored by businesses and multi-family residences

DISADVANTAGES
Does not allow for bike lanes
Ineffective on roadways with frequent driveways
Potential safety concerns when backing out

2.0 VOLUME CONTROL MEASURES

VOLUME CONTROL MEASURES reduce the quantity of vehicles that use the roadway. They use barriers to restrict one or more movements at an intersection. Their primary purpose is to divert traffic away from the trouble area thus reducing cut-through traffic. Typical volume control measures are full street closures, half street closures, diagonal diverters, median barriers, and forced turn islands. Volume Control Measures are typically applied only after other measures have failed or been determined inappropriate. Pedestrian and bicycle traffic can usually be accommodated. Volume Control Measures are often used in sets to make travel through neighborhoods more circuitous, and are typically staggered internally in a neighborhood, which leaves through movement possible but less attractive than alternative (external) routes. Volume Control Measures have also been used as a crime prevention tool.

2.1 FULL CLOSURE

FULL STREET CLOSURES are barriers are placed across a street to completely close the street to through-

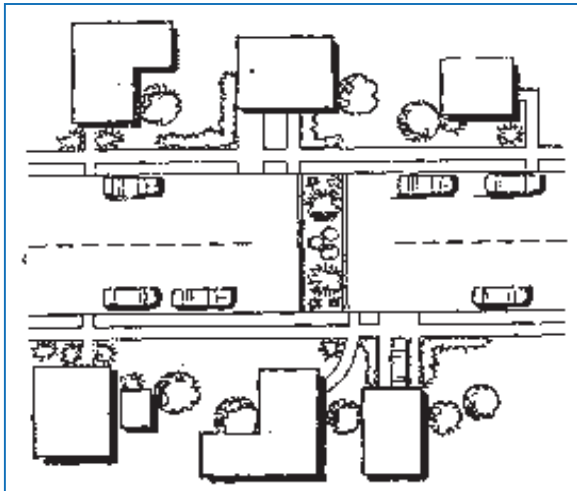


Figure 7: Full-Street Closure Diagram



Figure 8: Full-Street Closure

traffic, usually leaving only sidewalks open. Pedestrian and bicycle traffic are usually unrestricted. Typical barriers include: landscaped islands, walls, gates, side-by-side bollards, posts, etc. The barrier should be designed to eliminate vehicles (e.g. passenger cars) from entering.

Effectiveness: Average 44% decrease in traffic volume

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> Able to maintain pedestrian and bicycle access Does not adversely affect access by children Very effective in reducing traffic volumes 	<ul style="list-style-type: none"> Cause indirect routes for local residents and emergency vehicles May limit access to businesses May be expensive

2.2 HALF CLOSURE

HALF CLOSURES are barriers that block travel in one direction for a short distance on otherwise two-way



Figure 9: Half Closure

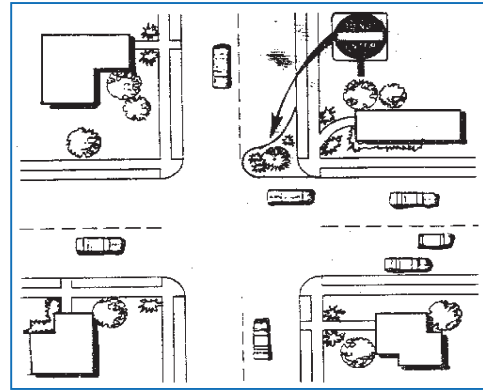


Figure 10: Half Closure Diagram

streets; they are sometimes called partial closures, entrance barriers, or one-way closure. Typical barriers include: landscaped islands, walls, gates, side-by-side bollards, posts, etc.

Effectiveness: Average 42% decrease in traffic volume

ADVANTAGES
Able to maintain pedestrian and bicycle access
Does not affect emergency vehicles
Effective in reducing traffic volumes

DISADVANTAGES
Cause indirect routes for local residents
May limit access to businesses
May be expensive
Drivers can circumnavigate barrier

2.3 MEDIAN BARRIER

MEDIAN BARRIERS are raised islands in the centerline of a street and continuing through an intersection that block the left turn movement from all intersection approaches and the through movement at the cross street.

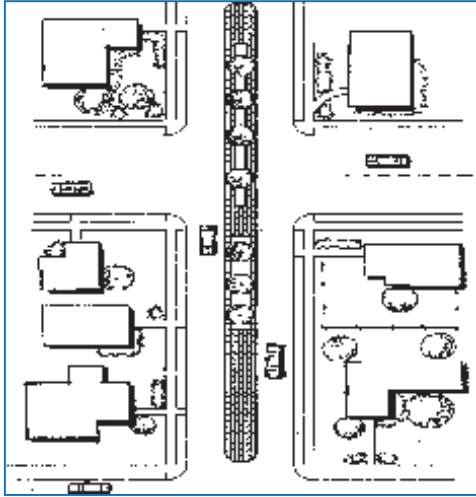


Figure 12: Median Barrier Diagram



Figure 11: Median Barrier

Effectiveness: Average 31% decrease in traffic volume

ADVANTAGES
Can improve safety at intersection by prohibiting dangerous turning movements
Can reduce traffic volumes on a cut-through route that crosses the major street

DISADVANTAGES
May require right-of-way acquisition
Limits turns to and from side street for local residents
May limit access for emergency vehicles

2.4 FORCED TURN ISLAND

FORCED TURN ISLANDS are barrier islands that block certain movements on approaches to an intersection. Designs can vary significantly depending on the installation location. Forced turn islands are best when used on residential streets at intersections with larger streets. The larger street can accommodate the diverted and will cut down on the number of vehicles that might attempt to circumnavigate the measure. Occasionally additional center line barriers or channelization required to keep drivers from circumnavigating islands.



Figure 13: Forced Turn Island

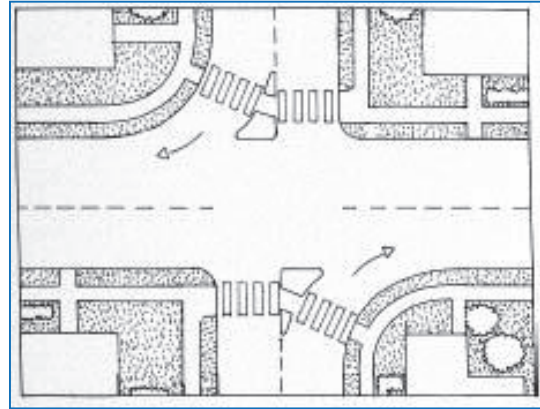


Figure 14: Forced Turn Island Diagram

Effectiveness: No Data

ADVANTAGES

Can improve safety at intersection by prohibiting dangerous turning movements

DISADVANTAGES

- May simply divert traffic problem to a different street
- May limit access for local residents

3.0 HORIZONTAL SPEED CONTROL MEASURES

HORIZONTAL SPEED CONTROL MEASURES are segments of roadway where the straight line of travel has been altered to cause a vehicle to change direction and slow down. Typical horizontal speed control measures include chicanes, traffic circles, roundabouts, and lateral shifts.

3.1 TRAFFIC CIRCLE

A **TRAFFIC CIRCLE** is a raised island placed in an intersection which traffic circulates. Generally, traffic circles are circular in shape and have some type of landscaping in its center. Also, traffic circles have outer rings (truck aprons or lips) that are mountable so large vehicles can circumnavigate the small radius traffic circle.

Effectiveness: 11% reduction in 85th percentile travel speed. 29%-73% reduction in accidents.

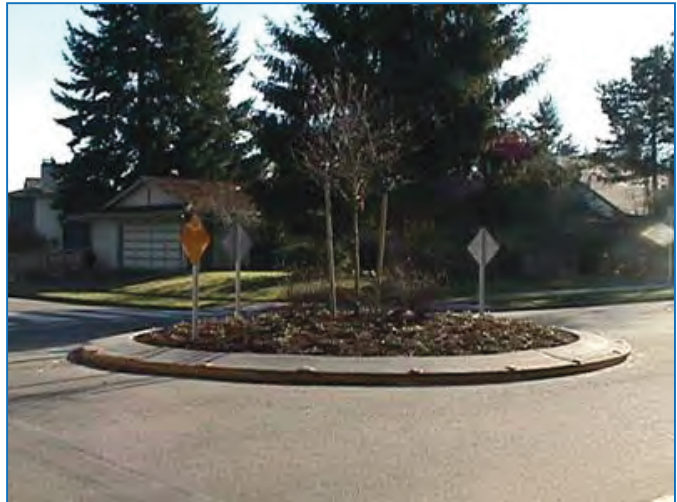


Figure 15: Traffic Circle

ADVANTAGES

- Provides increased access to street from side street
- Breaks up sight-lines on straight street
- Effective at lowering travel speeds

DISADVANTAGES

- Landscaping must be maintained
- Difficult for large vehicles (e.g. fire truck) to circumnavigate
- Potential loss of on-street parking
- May require modifications to curb, gutter and sidewalks

3.2 ROUNDABOUT



Figure 16: Roundabout

A **ROUNDABOUT** is similar to a traffic circle. It also has a raised island placed at an intersection with circulating traffic. However, there are differences. Roundabouts generally are much larger than traffic circles and thus need more land for construction. Roundabouts are used at intersections with higher traffic volumes and are designed for higher speeds. Roundabouts generally have raised splitter islands that direct traffic to the right, this helps form gaps in traffic. Roundabouts may also have flared entry lanes, which increase the capacity of the intersection.

Roundabouts may also have bypass lanes to allow driver to travel through the area without entering the intersection at all.

Effectiveness: 29% reduction in accidents.

ADVANTAGES	DISADVANTAGES
Enhanced safety compared to traffic signal	Landscaping must be maintained
Minimizes queuing at approaches	May require major reconstruction and extensive right-of-way
May be effective at slowing travel speed	Potential loss of on-street parking
	Increase pedestrian distance and travel time on crosswalks

3.3 CHICANE

CHICANES are curb extensions or edge islands that alternate from one side of roadway to the other. These curb extensions or edge islands give the roadway more ‘winding’ attribute. Curb extensions or edge islands can be semi-circular, triangular or squared off. Trapezoidal islands have been found to be more effective at reducing speeds than semi-circular shapes. Curb extensions or edge islands should have a vertical element to draw attention to them. Trees and other landscape materials are an option. For low speed roadways or roadways that lack right-of-way, mountable curbs are also an option to allow larger vehicles to maneuver through the chicanes.



Figure 17: Chicane

Chicanes can also be formed by alternative on-street parking from one side of the roadway to the other. Parking bays can be created using striping or by installing landscaped islands at each end.

Effectiveness: No Data

ADVANTAGES

Discourages high speeds by forcing horizontal deflection

Negotiable by large vehicles (e.g. fire truck)

DISADVANTAGES

Landscaping must be maintained

Require major reconstruction and extensive right-of-way

Potential loss of on-street parking

3.4 LATERAL SHIFT

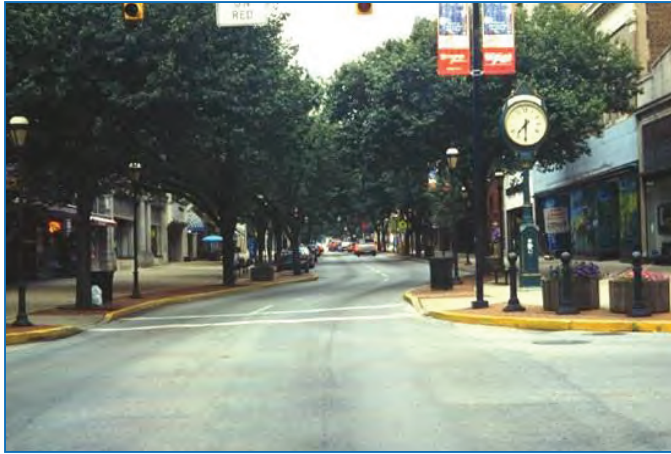


Figure 18: Lateral Shift

Effectiveness: No Data

A **LATERAL SHIFT** is like a chicane, however the roadway alignment only shifts once. It is only one curb extension or edge island rather than a series of alternating curb extensions or edge islands. Because the road alignment shifts only once, the crossing speed is approximately 5 mph higher than a series of chicanes. A higher speed means that lateral shifts can be placed on higher functional classification roadways (collectors and arterials) .

Typical lateral shifts incorporate a landscaped center island to separate opposing traffic. This prohibits drivers from veering into the opposite lane.

ADVANTAGES

- Can accommodate higher traffic volumes
- Negotiable by large vehicles (e.g. fire truck)

DISADVANTAGES

- Potential loss of on-street parking
- May require additional design effort

4.0 NARROWING MEASURES

NARROWING MEASURES are short roadway segments that are narrower than the typical roadway section. Typical narrowing measures are neckdowns, chokers, and island narrowing.

4.1 NECKDOWN

NECKDOWNS are curb extensions at an intersection. These neckdowns reduce the roadway width from curb to curb and provide shorter pedestrian crossing distances and times. The short curb return radius also reduces the speeds of turning vehicles.

Effectiveness: 7% reduction in 85th percentile speed.

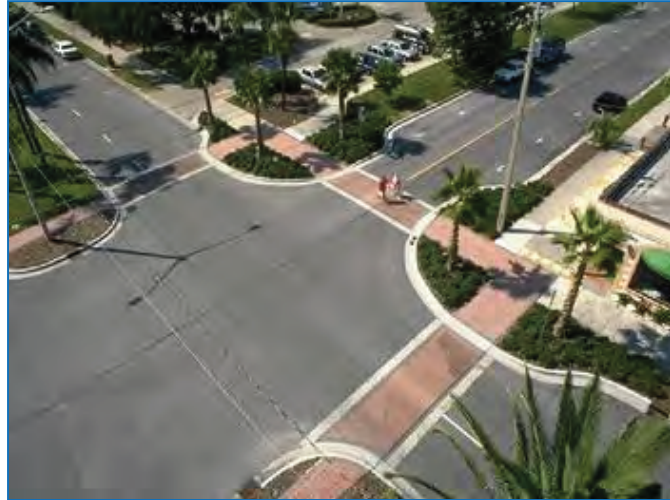


Figure 19: Neckdown

ADVANTAGES

- Improves pedestrian comfort and safety
- Through and left turn movements are negotiable by large vehicles (e.g. fire trucks)
- Can create protected on-street parking
- May reduce speeds and traffic volumes

DISADVANTAGES

- Effectiveness may be limited because there is no vertical or horizontal deflection
- Right turn not easily negotiable by large vehicles (e.g. fire trucks)
- Potential loss of on-street parking
- May bring bicycle lanes in closer proximity with travel lanes
- May change or restrict drainage

4.2 CHOKER



CHOKERS are curb extensions at mid-block that narrow the roadway by widening the sidewalk, planting strip, or centerline. A typical two-lane choker is 20 feet from curb to curb. One-lane chokers narrow the roadway to just one travel lane. This is similar to a one-lane bridge condition. The constricted length in the direction of travel varies but should be kept short enough not to block the driveways or accesses.

Effectiveness: 7% reduction in 85th percentile speed.

Figure 20: Choker

ADVANTAGES	DISADVANTAGES
Negotiable by large vehicles (e.g. fire trucks)	Effectiveness may be limited because there is no vertical or horizontal deflection
May reduce travel speeds and volumes	May bring bicycle lanes in closer proximity with travel lanes
Can have positive aesthetic value	Potential loss of on-street parking
	One-lane choker can only be used on extremely low volume roadways without causing safety concerns or traffic congestion
	May limit driveway access

4.3 CENTER ISLAND

CENTER ISLANDS are raised barriers in the center of the roadway that narrow the travel lanes. The center island should be large enough to draw attention (e.g. 6 feet wide by 20 feet long). The center island can also be offset to the left from the perspective of approaching traffic. They are often landscaped and can be used as refuge for pedestrians crossing the roadway. Center islands create intermittent left turn areas rather than a continuous median. Center islands placed at intersections or entrances to neighborhoods are often called gateways.



Effectiveness: 7% reduction in 85th percentile speed.

Figure 21: Center Island

ADVANTAGES	DISADVANTAGES
Increases pedestrian safety	Effectiveness may be limited because there is no vertical or horizontal deflection
May reduce travel speeds and volumes	Potential loss of on-street parking
Can have positive aesthetic value	If center island is too long, channelized traffic may increase travel speed
	Plants and irrigation must be kept to a minimum due to pavement deterioration from water runoff

5.0 APPROPRIATENESS OF TRAFFIC CALMING MEASURES

After identifying and characterizing the traffic problem, one can select the appropriate traffic calming measure to be implemented. The major types of traffic problems are:

- Speed – vehicle speeds are too high.
- Traffic Volume – vehicle usage levels are too high and are affecting level of service.
- Safety – vehicles have excessive level of risk (e.g. accident history). Pedestrians and bicyclists are at unnecessary risk due to vehicles.
- Pollution – vehicles cause excessive levels of noise, vibration, and air pollution.

Besides the traffic problem types, there are other issues such as location and traffic constraints that can be investigated. The following **TABLE 1** and **TABLE 2** present each traffic calming measure and its appropriateness versus problem type, location type and traffic constraints. The appropriateness is an assessment derived from the literature search of the state of the industry and results from other agencies.

Table 1: Traffic Calming Measures versus Traffic Problem Type

Traffic Calming Measure	Traffic Problem Type			
	Speed	Traffic Volume	Safety	Pollution
1.0 Non-Physical				
1.1 Speed Enforcement	●	●	●	●
1.2 Lane Striping	●	●	●	●
1.3 Signage	●	●	●	●
1.4 Speed Legend	●	●	●	●
1.5 Raised Pavement Marker	●	●	●	●
1.6 Angled Parking	●	●	●	●
2.0 Volume Control				
2.1 Full Closure	●	●	●	●
2.2 Half Closure	●	●	●	●
2.3 Diagonal Diverter	●	●	●	●
2.4 Median Barrier	●	●	●	●
2.5 Forced Turn Island	●	●	●	●
3.0 Vertical Speed Control				
3.1 Speed Hump	●	●	●	●
3.2 Speed Table	●	●	●	●
3.3 Raised Crosswalk	●	●	●	●
3.4 Raised Intersection	●	●	●	●
4.0 Horizontal Speed Control				
4.1 Traffic Circle	●	●	●	●
4.2 Roundabout	●	●	●	●
4.3 Chicane	●	●	●	●
4.4 Lateral Shift	●	●	●	●
5.0 Narrowing				
5.1 Neckdown	●	●	●	●
5.2 Choker	●	●	●	●
5.3 Center Island	●	●	●	●

Legend:

● Strongly Appropriate; ● Moderately Appropriate; ● Moderately Inappropriate; ● Inappropriate

Table 2: Traffic Calming Measure versus Location Type

Traffic Calming Measure	Traffic Problem Type			
	Residential		Non-Residential	
	Mid-Block	Intersection	Mid-Block	Intersection
1.0 Non-Physical				
1.1 Speed Enforcement	●	●	●	●
1.2 Lane Striping	●	●	●	●
1.3 Signage	●	●	●	●
1.4 Speed Legend	●	●	●	●
1.5 Raised Pavement Marker	●	●	●	●
1.6 Angled Parking	●	●	●	●
2.0 Volume Control				
2.1 Full Closure	●	●	●	●
2.2 Half Closure	●	●	●	●
2.3 Diagonal Diverter	●	●	●	●
2.4 Median Barrier	●	●	●	●
2.5 Forced Turn Island	●	●	●	●
3.0 Vertical Speed Control				
3.1 Speed Hump	●	●	●	●
3.2 Speed Table	●	●	●	●
3.3 Raised Crosswalk	●	●	●	●
3.4 Raised Intersection	●	●	●	●
4.0 Horizontal Speed Control				
4.1 Traffic Circle	●	●	●	●
4.2 Roundabout	●	●	●	●
4.3 Chicane	●	●	●	●
4.4 Lateral Shift	●	●	●	●
5.0 Narrowing				
5.1 Neckdown	●	●	●	●
5.2 Choker	●	●	●	●
5.3 Center Island	●	●	●	●

Legend:

● Applicable; ● Applicable in Some Cases; ● Not Applicable

6.0 GENERAL DESIGN PRINCIPLES

The following are general design principles that should be considered before and after traffic calming measure implementation.

6.1 DATA COLLECTION

One of the initial steps that should be considered prior to traffic calming measure implementation is data collection. The following data items can be collected:

1. Twenty-four (24) hour directional approach volumes for each leg of an intersection should be obtained to identify the heaviest eight hours.
2. Twenty-four (24) hour directional volumes for the roadway should be obtained to identify the heaviest eight hours.
3. Percentage of large trucks that would be using the roadway or intersection.
4. Posted speeds for all roadways.
5. 85th percentile speed for all intersection approaches and roadways.
6. Miscellaneous data, such as existing roadway geometry, drainage information, area population, land uses, distances to intersections, and intersection control treatments.
7. Bicycle and pedestrian counts for intersections and midblock locations.
8. Detailed accident data to analyze the frequency and types of collisions occurring at intersections or along roadways.
9. Community considerations should be investigated, including the need for parking, the landscaping character of the area and existence of other existing traffic calming measures.
10. Transit routes and frequencies in the study area.

6.2 APPLICATION GUIDELINES

Criteria that should be considered are listed below for the different physical traffic calming measures.

6.2.1 VOLUME CONTROL

The following criteria should be considered when installing volume control measures:

1. Roadway segments with daily traffic volumes less than 5,000 vehicles per day.
2. Intersections with only one lane per approach.
3. 25% of traffic is non-local traffic.

6.2.2 VERTICAL SPEED CONTROL

The following criteria should be considered when installing vertical speed control measures:

1. Daily traffic volume less than 7,500 vehicles per day.

2. Speed humps should be considered if the daily traffic volume is less than 4,000 vehicles per day.
3. Posted speed limit is 25 mph or less.
4. Approach or street grades of less than 5%.

6.2.3 HORIZONTAL SPEED CONTROL

The following criteria should be considered when installing horizontal speed control measures:

1. All roadway functional classes.
2. Traffic circles and chicanes should only be considered if the daily entering traffic volume is less than 5,000 vehicles per day.
3. Traffic circles should be considered on intersections where there is one lane per approach.
4. Low volumes of buses and trucks (less than 2%).
5. Posted speed limit of 25 mph or less.
6. Roundabouts should only be considered where the grade on the approach streets is less than 5%.

6.2.4 NARROWING CONTROL

The following criteria should be considered when installing narrowing control measures:

1. All roadway functional classes.
2. One lane chokers should only be considered if the daily entering traffic volume is less than 3,000 vehicles per day.
3. Posted speed limit of 25 mph or less.
4. Bicycle and pedestrian traffic should be accommodated in design.

6.2.5 OTHER CONSIDERATIONS

The following are other considerations that are applicable to all traffic calming measures:

1. Community sentiment.
2. Number and types of accidents.
3. Presence of pedestrian crosswalks.
4. Presence of curb and gutter.
5. Drainage.
6. Presence of parking.
7. Location within roadway network (e.g., minimum distance from other intersections).
8. Emergency vehicles, bus routes, snow plowing routes.
9. Previously attempted traffic calming measures (e.g., targeted speed enforcement, painted speed legends etc.).

6.3 GEOMETRY

The following are general criteria that should be considered when installing traffic calming measures.

1. Examine as-is geometry of roadway or intersection.
2. Check physical feasibility of installing traffic calming measure.
3. Determine desired crossing speed (i.e., design speed) at slow points of traffic calming measure.
 - a. For vertical speed control measures (e.g., speed humps), the typical design speed is 25 to 30 mph. Speed versus vertical curvature relationships can be found in ITE's *Traffic Calming State of Practice*.
 - b. For horizontal speed control measures, (e.g., traffic circles and roundabouts), the center islands and circular perimeters need to be determined. Speed versus horizontal curvature relationships can be found in AASHTO's *A Policy on Geometric Design of Highways and Streets*.

6.4 SAFETY

As part of installing any traffic calming measure, signing and pavement markings should be incorporated as well. Agencies use the *Manual on Uniform Traffic Control Devices* (MUTCD) as general guidance; however, the MUTCD is not specific on any traffic calming measure.

1. Signage and pavement markings shall be designed using the latest *Manual on Uniform Traffic Control Devices* (MUTCD) as guidance. The following items should be considered:
 - Warning signs need not be used where hazards are self-evident.
 - Signs must be legible, which requires high visibility, lettering or symbols of adequate size and short legends for quick comprehension.
 - Sign lettering must be in upper-case letters of the type approved by the City and FHWA.
 - Signs must be reflectorized or illuminated to show the same shape and color by day and night.
 - Signs are ordinarily placed on the right-hand side of the road, where the driver is looking for them.
 - Signs are ordinarily mounted separately, except where one sign supplements another, as advisory speed plates supplement warning signs.
 - Before any street is opened to traffic, all hazardous conditions must be signed and marked.
 - Signs should be used conservatively.
 - Symbol signs are preferred to word signs when an appropriate symbol exists.
 - New symbols not readily recognizable should be accompanied by educational plaques.
 - Analogous signs shall be used for new situations similar to those for which standard signs already exist.
2. Signs should be limited to minimize confusion.
3. Signs should be placed in advance to warn drivers. Placement of advance warning signs should conform to guidance provided in the latest MUTCD.
4. Check sight distances by visiting sight before and after traffic calming measure installation.

5. Depending on the characteristics of the intersection, pedestrian crosswalk signs and pavement markings may be needed and should follow guidance provided in the latest MUTCD (*Section 3B.17 & Section 2C.37*).
6. Depending on the characteristics of the intersection, bicycle lane signs and pavement markings may be needed and should follow guidance provided in the latest MUTCD.
7. If sidewalk ramps are needed, they should be constructed according the latest City standards and be ADA compliant.
8. Depending on the characteristics of the intersection, “no parking” signs may be needed as well as red painted curbs to properly mark the intersection.
9. Lighting should be installed to provide safe illumination. The following items should be considered:
 - Good illumination should be provided on the approach nose of the splitters islands, the conflict area where traffic enters the circulating stream and places where traffic streams separate at points of exits.
 - If applicable, pedestrian crossing areas should be illuminated.